



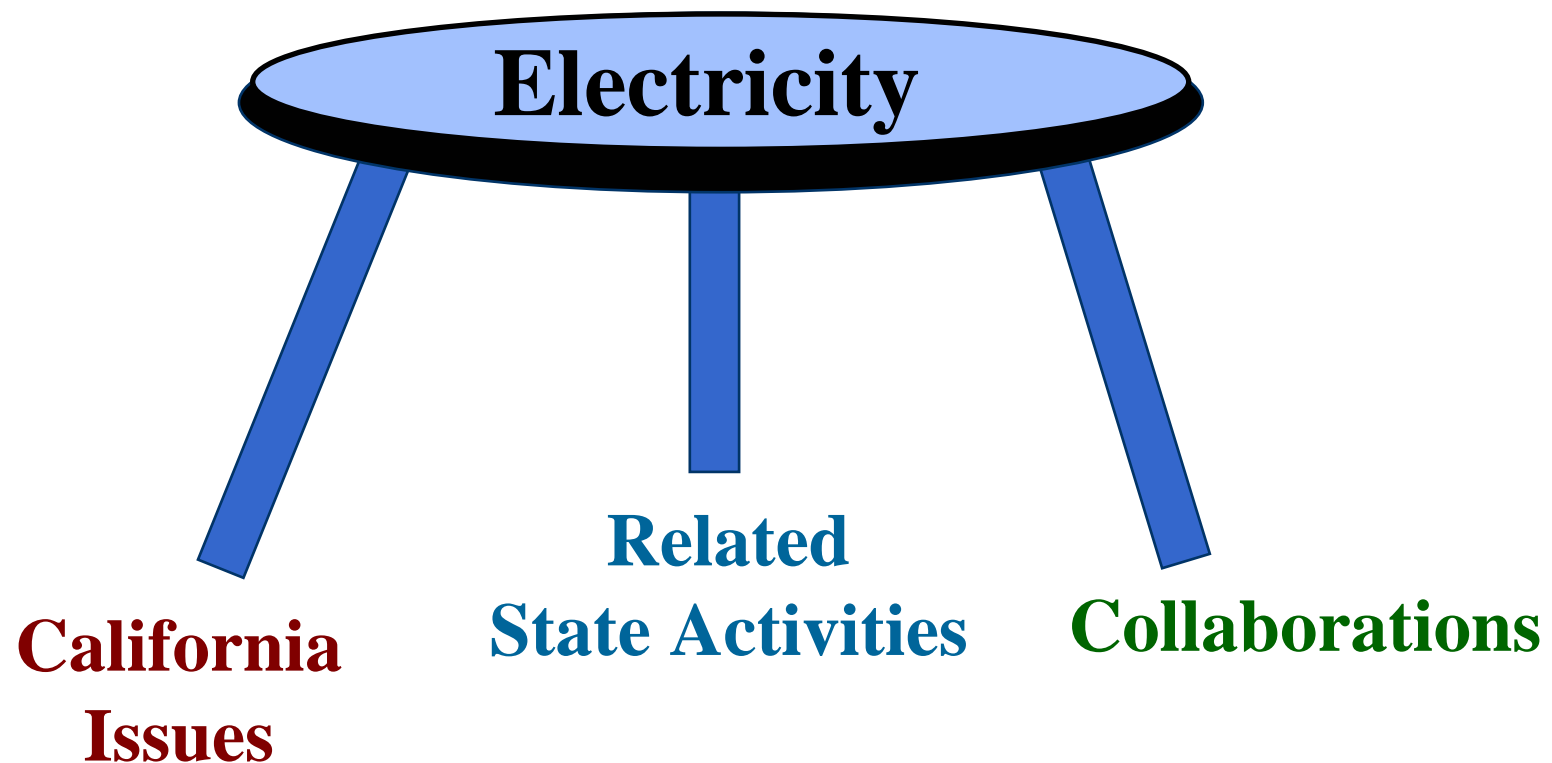
Joint Committee on Preparing California for The 21st Century

August 26, 2003

Terry Surles & George Simons
California Energy Commission



Policy and RD&D Must be Linked in Order to Provide Benefits to the State





RD&D Activities Should Connect with Synergistic State Regulatory, Incentive, and Subsidy Programs



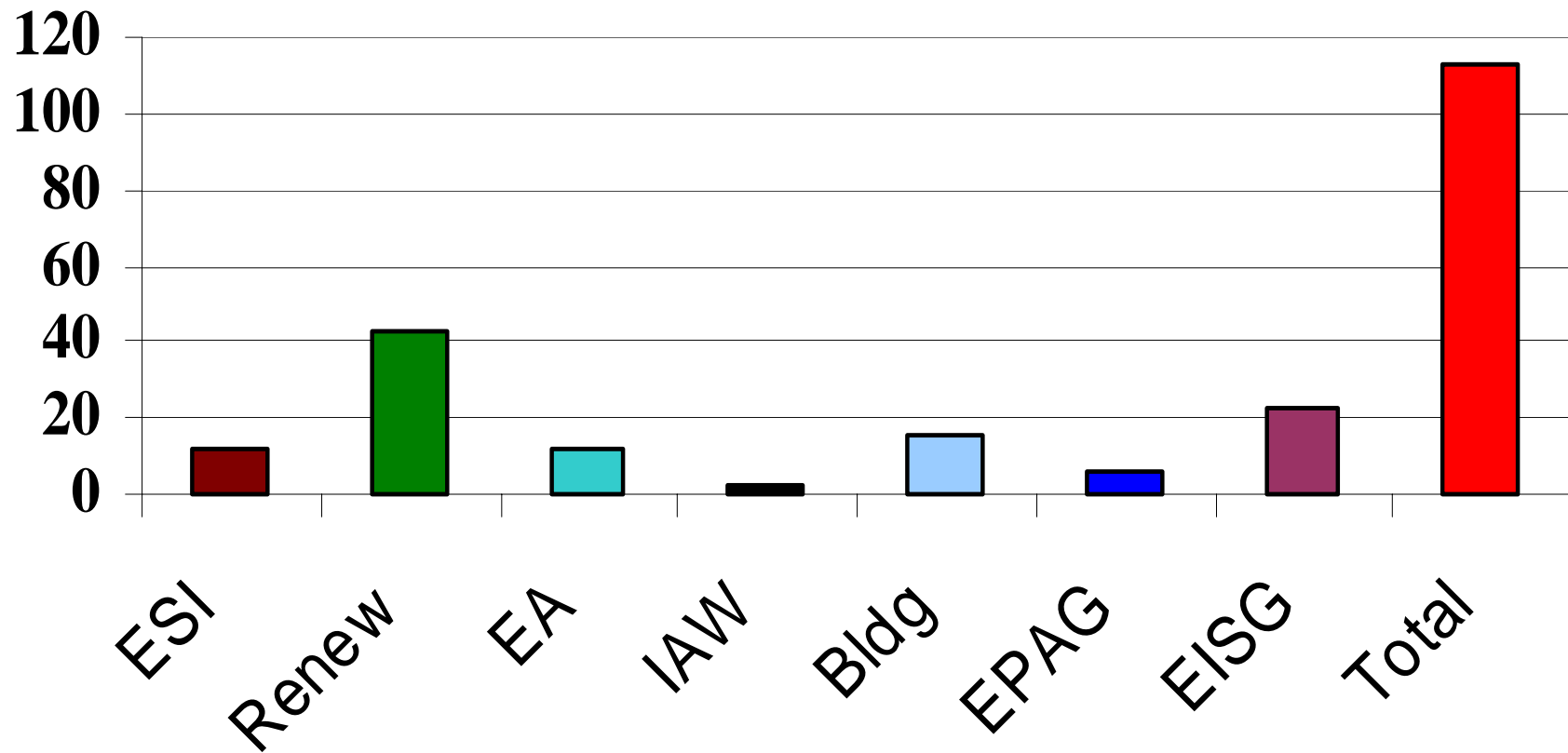
- ★ **Buildings** – Titles 20 and 24
- ★ **Renewables** – Renewable portfolio standard (RPS)
- ★ **Environmentally-Preferred Advanced Generation** – 2007 ARB rules on distributed generation emissions
- ★ **Energy Systems Integration** – CPUC/CEC initiatives in demand response/dynamic pricing, distributed energy resources, and transmission and distribution systems
- ★ **Environmental** – Impacts/opportunities related to RPS, state initiatives (AB 1493) in climate change



\$ External Funding Into State

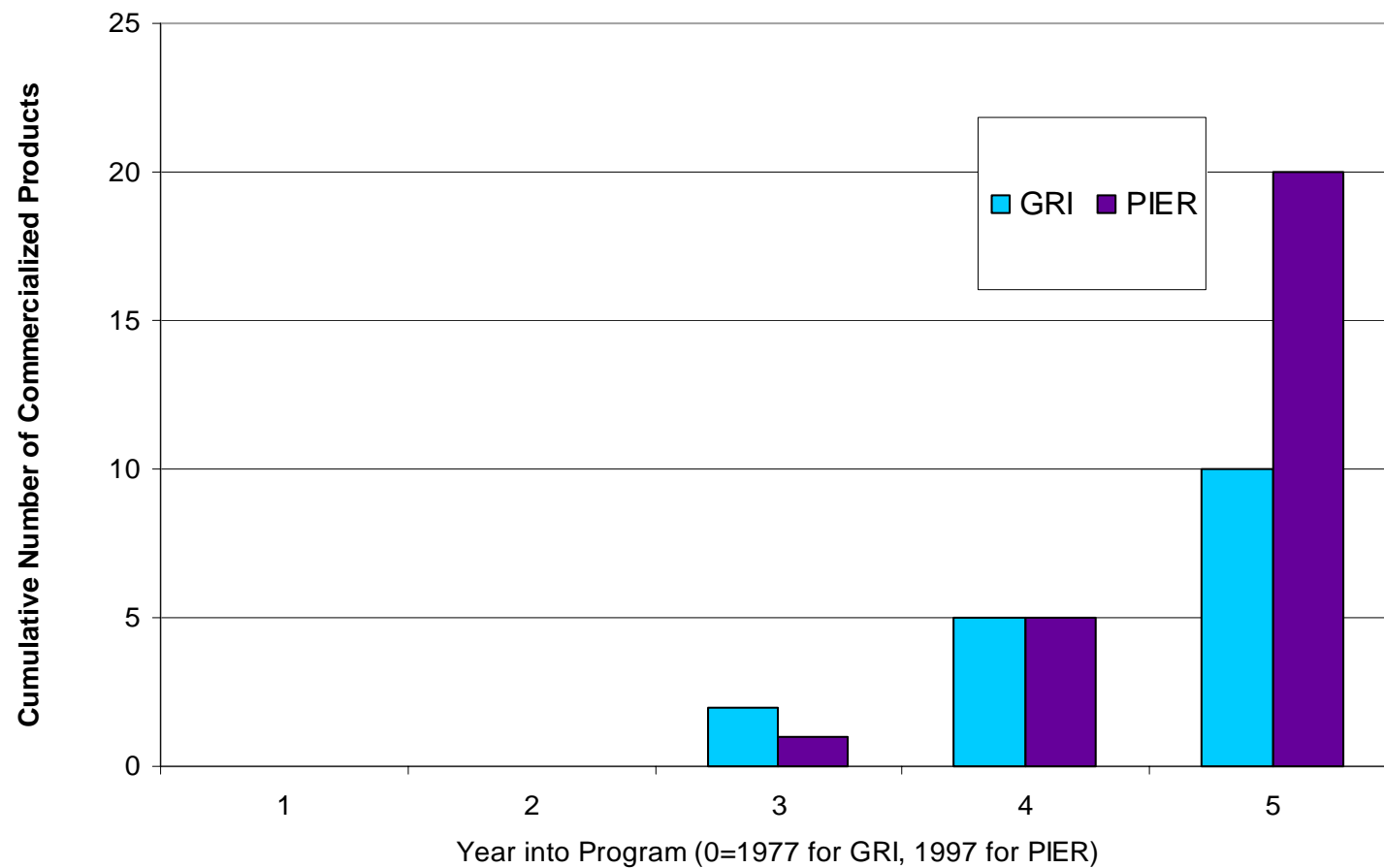


(in \$ Millions)



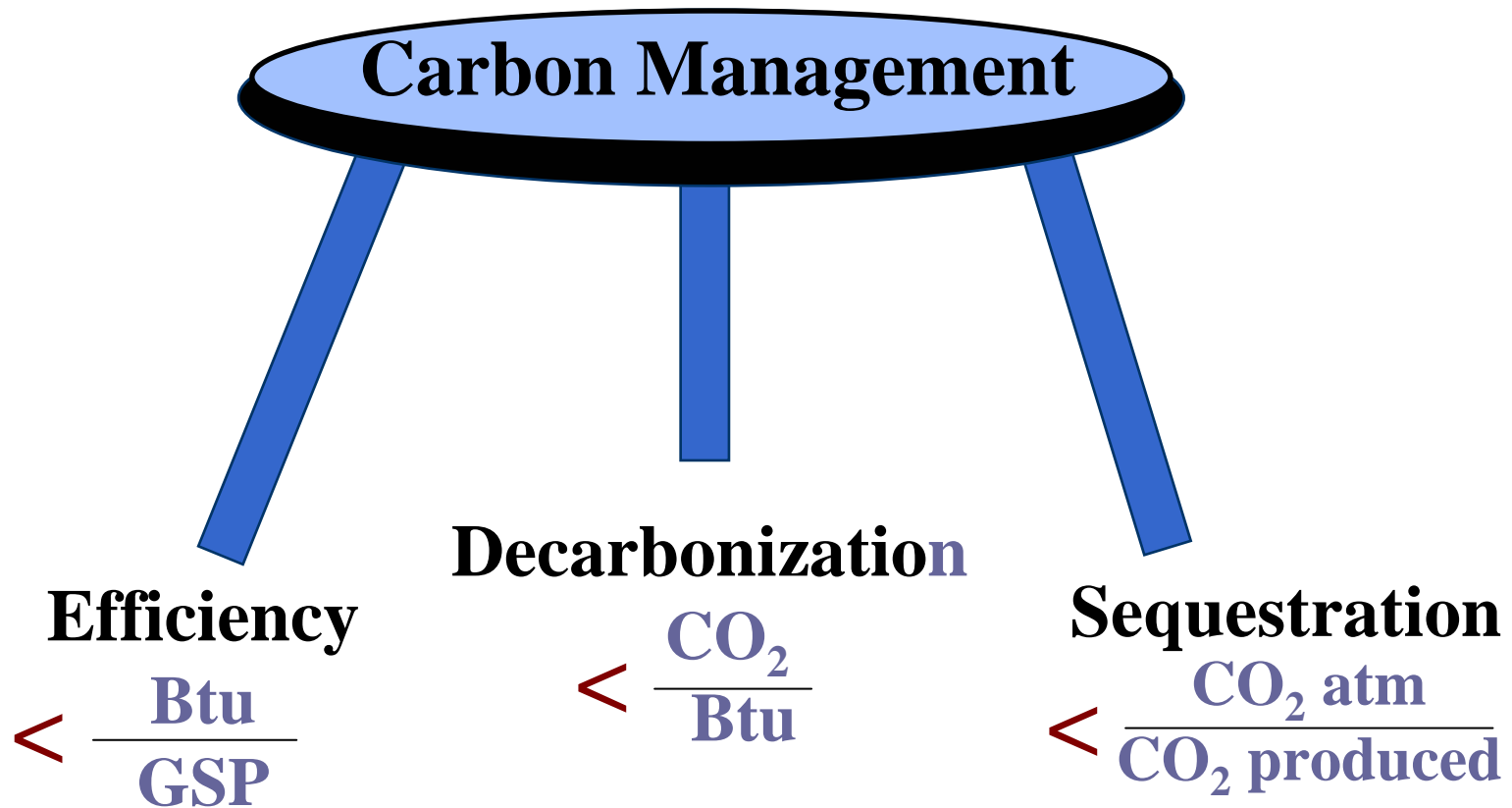


PIER vs. GRI Early Commercialization Success



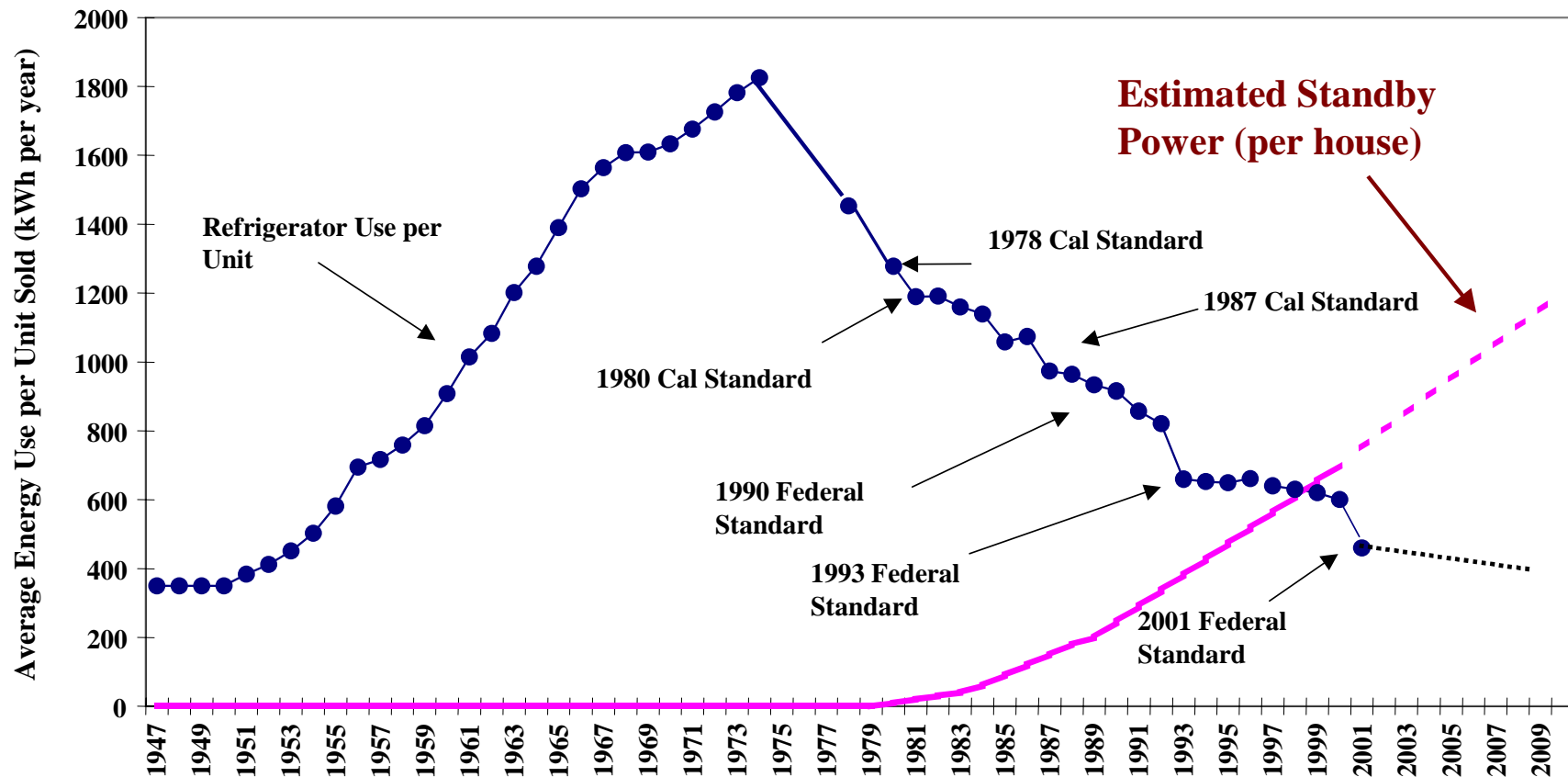


CEC R&DD for Improving Efficiency and Developing Distributed Resources also Addresses Climate Change



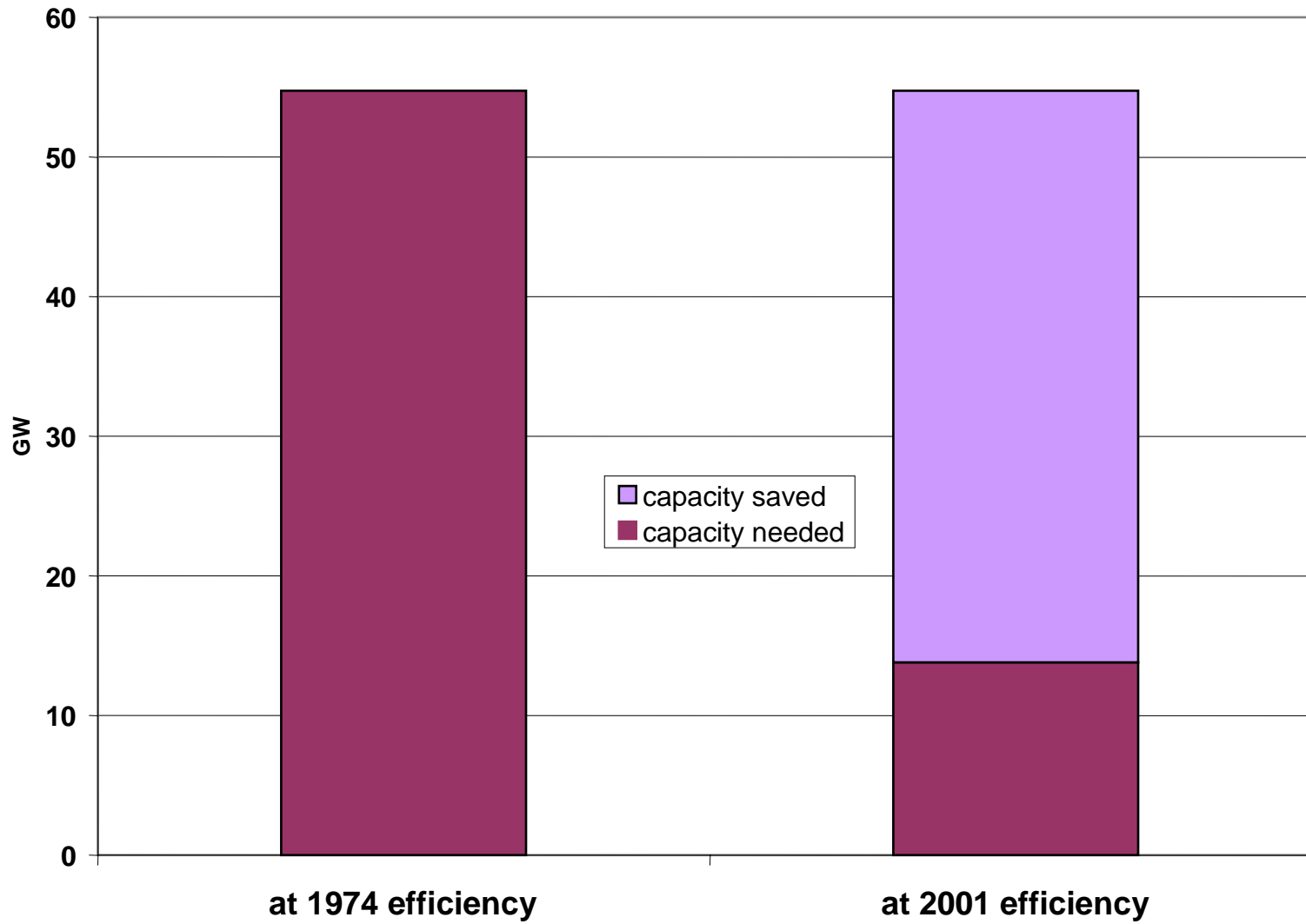


United States Refrigerator Use (Actual) And Estimated Household Standby Use v. Time



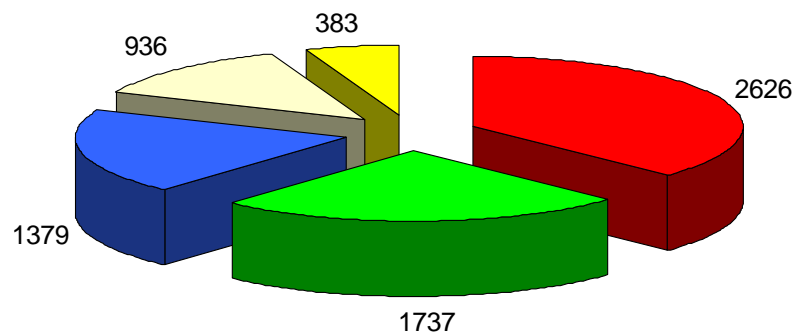


Electricity Generating Capacity for 150 Million Refrigerators + Freezers in the US



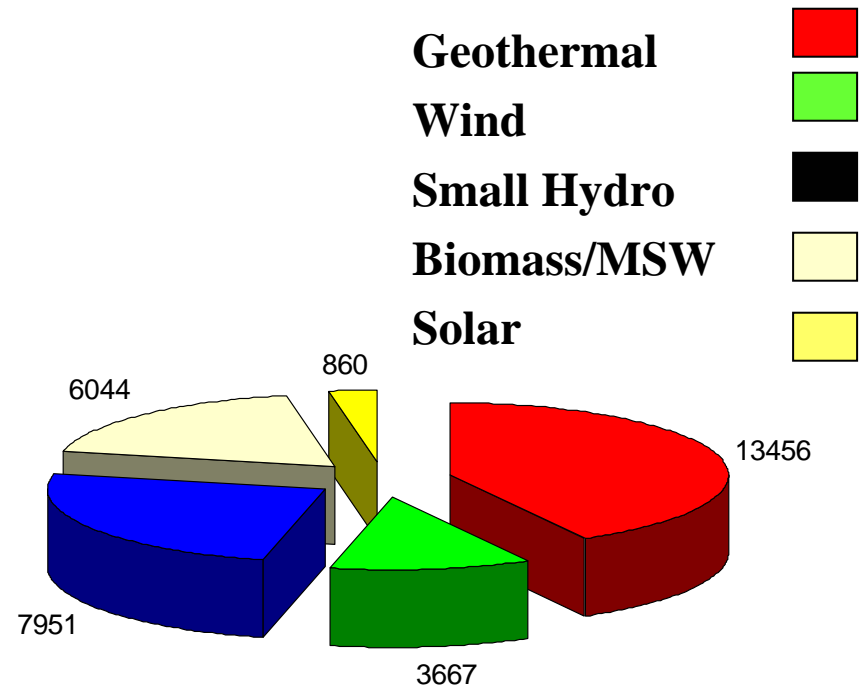


Existing Renewable Energy in California



Capacity (MWs)

~ 7000 MW total



Generated Electricity (GWhrs)

~ 33,000 GWhr/yr total



Goals for Future Renewable Development



★ **Mandated Goals**

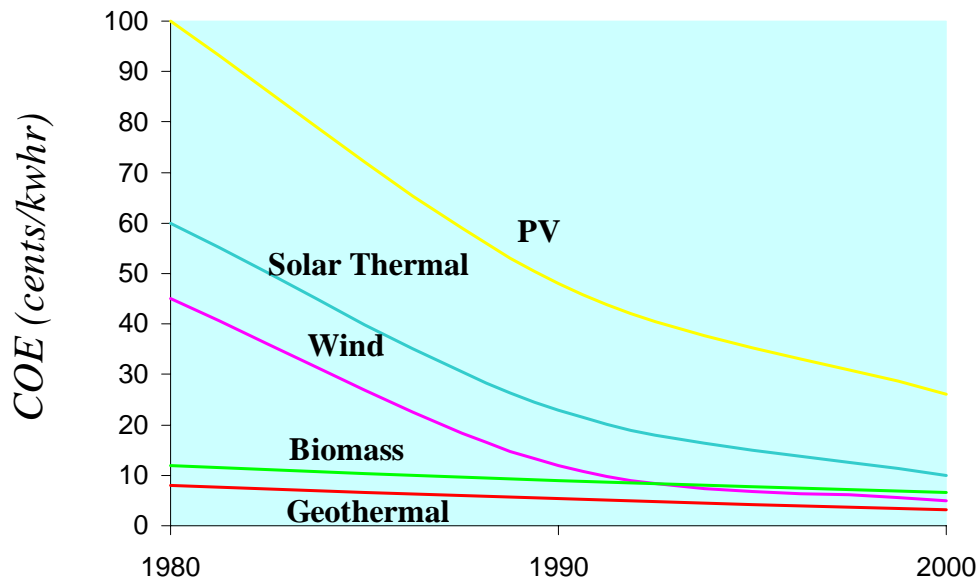
- ◆ **RPS: 20% by 2017**
- ◆ **EAP: 20% by 2010**
 - ~ 7000 MW and 40,000 GWhrs/yr of new renewables in 7 to 14 years

★ **Underlying Goals**

- ◆ **Addressing CA's electricity needs**
- ◆ **Generating significant societal benefits (non-energy)**
- ◆ **Regaining a leadership role**



Issues Facing CA Renewables Development



Typically utility-scale



Higher cost than conventional options

Some are intermittent



Risk of losing “green is clean” tag



Renewables in California:

A Rich Diversity



Wind



Biomass/MSW



Geothermal



Small Hydro



Solar



PIER Renewables: An Integrated Renewables Future

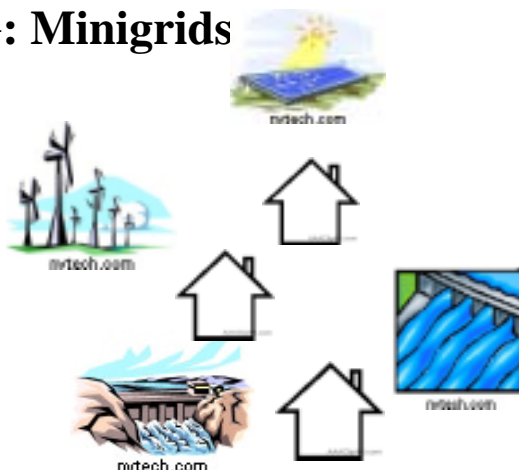


Demand Center Systems



Renewables integrated with efficiency, metering to help meet demand at the source; enhance customer choices

Interconnected DG: Minigrids



Diverse generation systems integrated among demand centers with dynamic controls and storage to meet localized capacity and reduce congestion

Strategic and “Super-Class” Bulk Systems



Next generation “super-class” renewables strategically located to help grid reliability & security



Moving Towards the Preferred Future

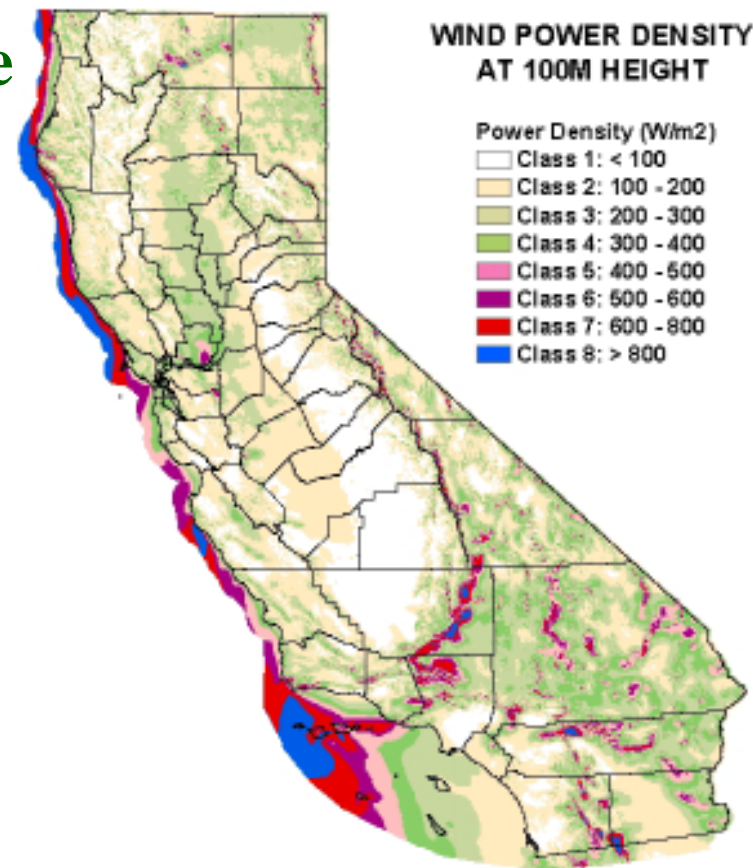
- ★ **Developing a realizable roadmap**
 - ◆ Up-to-date inventory of CA's renewables
 - ◆ Matching renewables to needs/opportunities
- ★ **Advancing preferred renewable technologies**
 - ◆ Focus on California's needs
- ★ **Facilitating responsive industries**
 - ◆ Collaborative approaches



Updating California's Renewable Resources: Wind Example



- ★ **More accurate and up-to-date**
- ★ **Wind Assessment Example**
 - ◆ 200 x 200 meter grid
 - ◆ Wind speeds and power
- ★ **Pending or Underway:**
 - ◆ Solar
 - ◆ Biomass
 - ◆ Ocean
 - ◆ Hydro

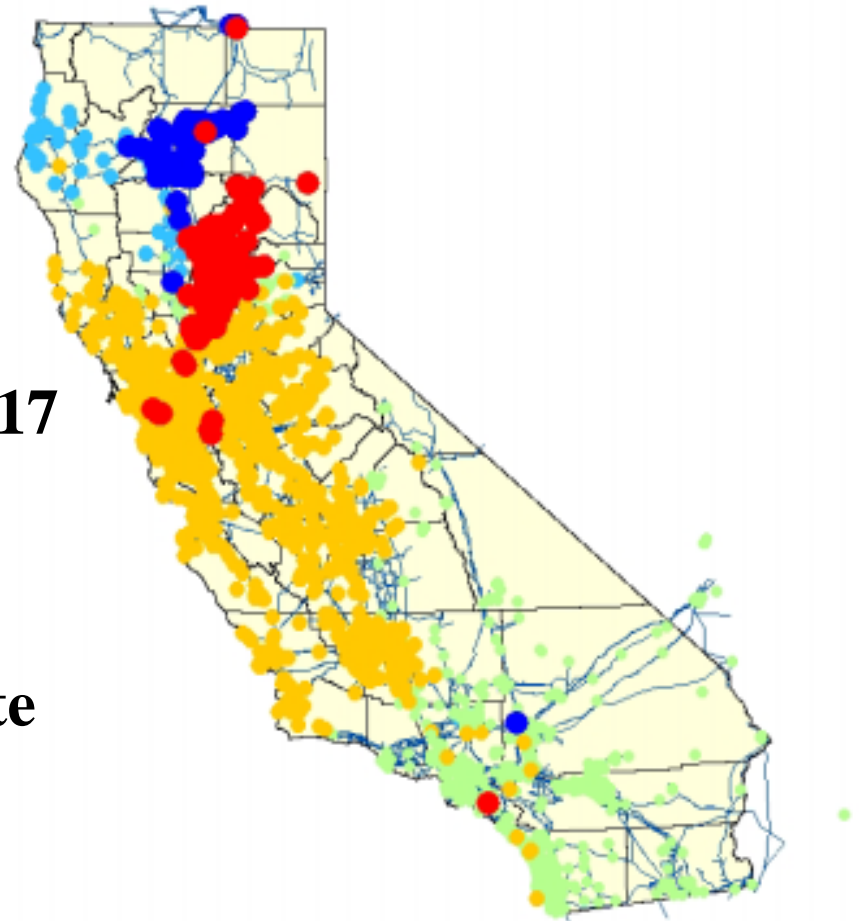




Identifying California's Electricity Needs



- ★ **Completed to date**
 - ◆ 2003, 2005, 2007
- ★ **Still to run**
 - ◆ 2009, 2011, 2013, 2015 & 2017
- ★ **Status**
 - ◆ Being reviewed internally
 - ◆ Need to integrate out-of-state transmission studies
 - ◆ Localized “case studies” pending





Integrating Renewable Assessments and Power Flows (**Wind Example**)



Wind power map



Wind power map with T&D system



Wind power map with T&D system and “hot spots”



Specific Example: CA Wind Potential (70m)



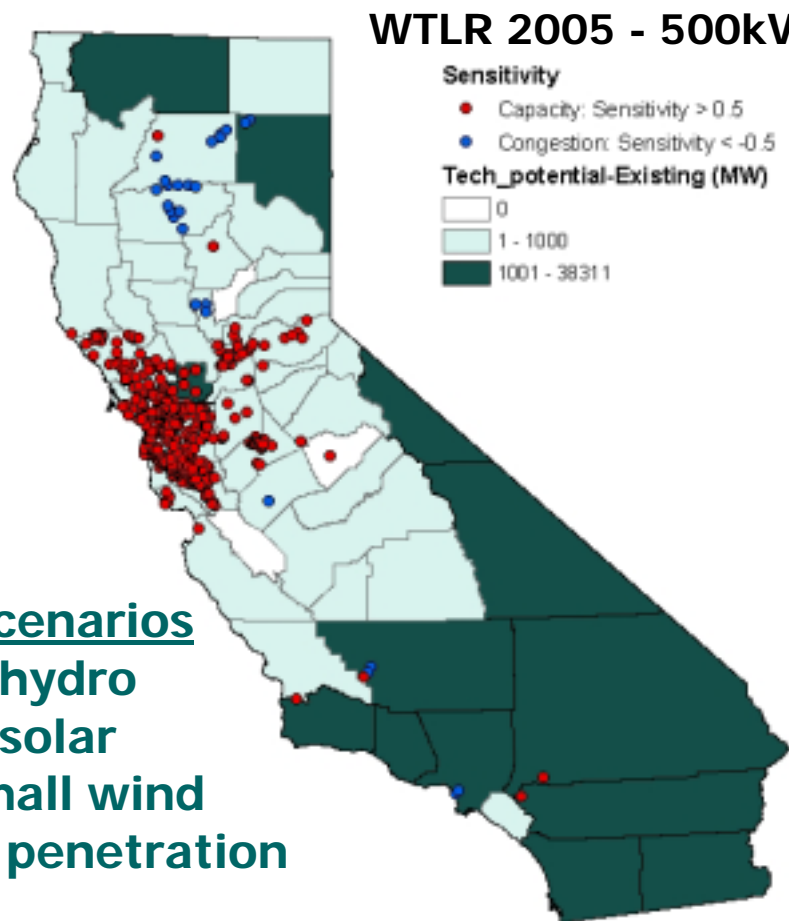
Gross Wind Potential: 295,187 MW
Technical Potential*: 99,945 MW
Current Installed: 1,752 MW
Opportunity: 98,193 MW

Technical Filters (excluded areas):*

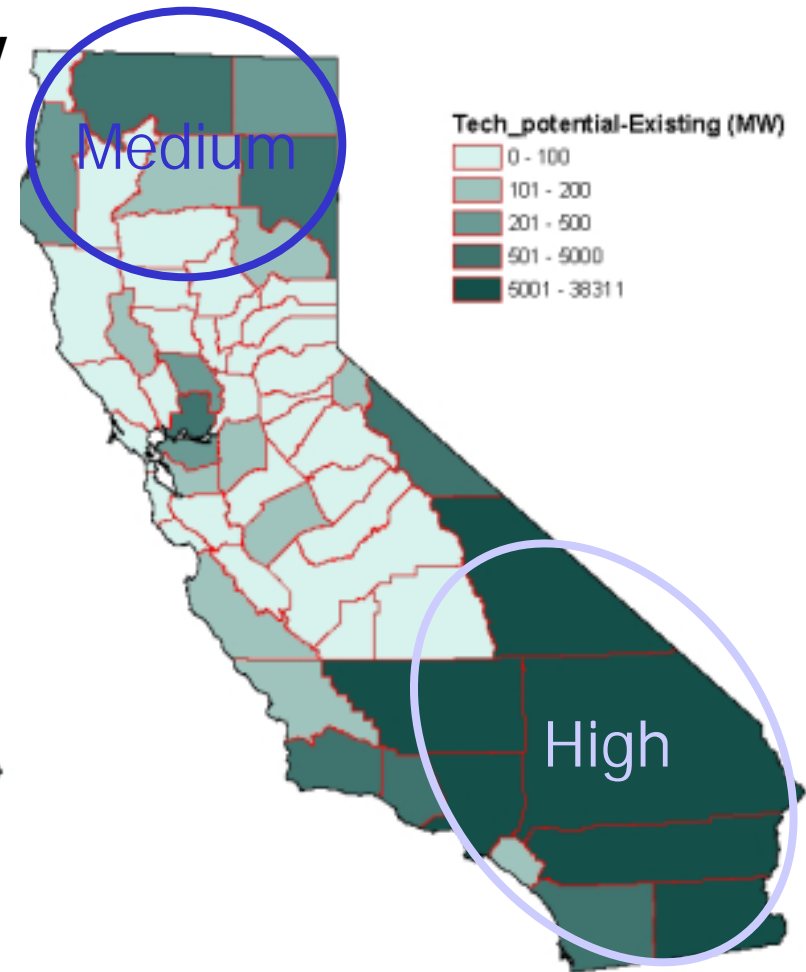
Resource $> 300 W/m^2$
Topography grade $> 20\%$
Bodies of Water
Forested Areas
Urban Areas
State/National Parks & Monuments
Others (Natural Reserves)



Wind Analysis – Looking at Capacity Needs and Resource Potential



Technical Wind Potential at 70 meter height minus existing developed



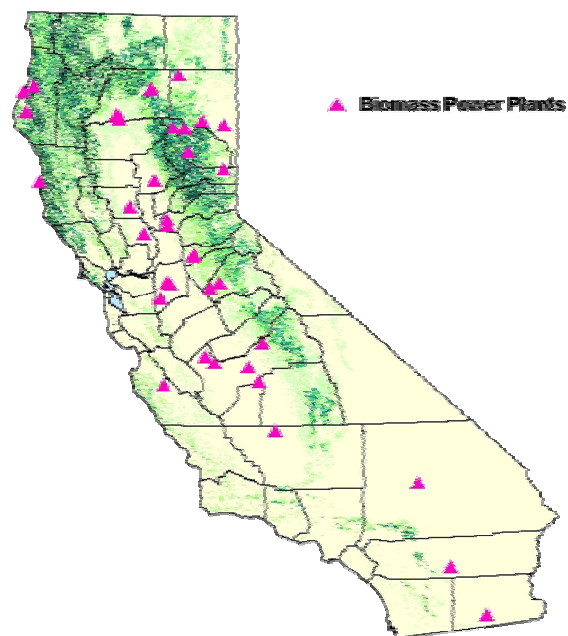
Wind potential at 70 meter height minus existing capacity

Other Scenarios

- Wind/hydro
- Wind/solar
- DG/small wind
- Urban penetration



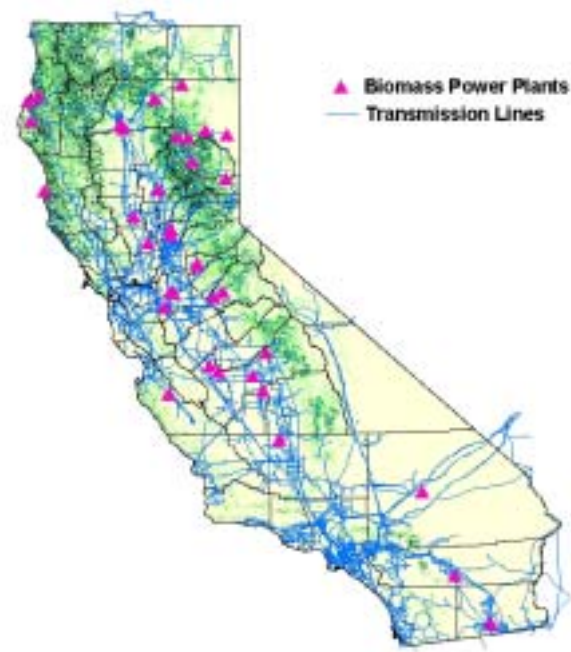
Integrating Renewable Assessments, Power Flows and Demographics



**Forest Biomass &
Bio Power Plants**



**Forest Wildfire
Threat Areas**



**Forest Biomass,
Bio Power Plants
and T&D System**



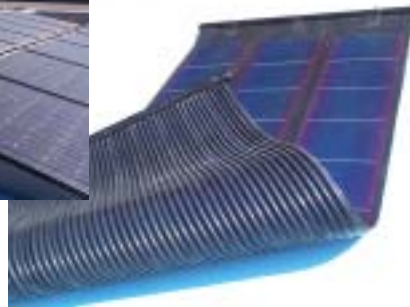
Developing Tomorrow's Renewable Technologies



*Making lower cost
and more reliable
wind*



*Integrating and
lowering costs of
solar*



*Reducing
geothermal
exploration costs*



*Developing biomass DG
solutions*



Collaborative Approach Tying Technology Development to CA Needs



- ★ **Municipal utility alliances:**
 - ◆ Focused on developing renewables that meet municipal utility electricity needs (SMUD, Hetch Hetchy/PRP)
- ★ **Local government partnerships:**
 - ◆ Using local renewable resources to address local environmental and growth issues (Yolo, San Francisco, San Diego)
- ★ **Industry connections:**
 - ◆ Working with industry leaders with market savvy, assets and vision (PowerLight, GE, AstroPower, Clipper, Western United Dairymen)
- ★ **Coordination with other government programs:**
 - ◆ Leveraging expertise and funding to help expedite development of effective renewable technologies (NREL, CARB, CIWMB, EPA)



Possible Benefits From Achieving the RPS Goal

| Benefits | Wind | Geothermal | Biomass | Solar | Small Hydro |
|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Capacity (MW) | 6730 | 2950 | 2520 | 800 | 1000 |
| Generation (GWhr/yr) | 19,300 | 22,200 | 14,600 | 2000 | 4800 |
| Avoided Emissions (tpy) | 9.6 million | 14.3 million | 8.5 million | 1.2 million | 3.8 million |
| State and Local Taxes | \$340 million | \$400 million | \$240 million | \$120 million | \$240 million |
| Employment (jobs) | 4900 | 5900 | 3900 | 800 | 1100 |

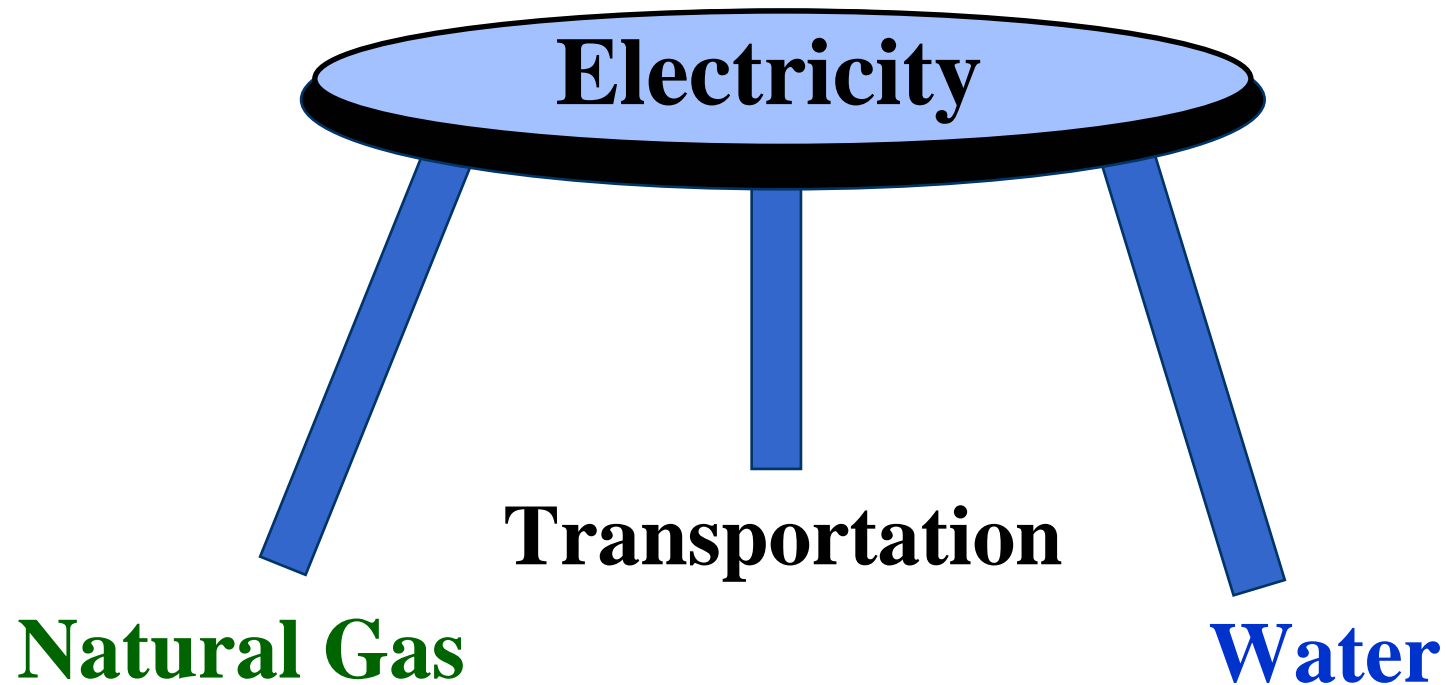


California Will be Well-Served by The Development Of An Integrated, Flexible, and Comprehensive Plan That Incorporates Externalities with Energy Supply and Demand

- * Complex system with lack of systems perspective**
- * Energy is only, intermittently, a big deal**
- * “Rube Goldberg” approach to energy policy**
- * Market is unable to address all societally or politically acceptable externalities**
- * New technologies do not address Joe Bagadonitz needs**



President's Commission on Critical Infrastructure Protection Highlights Vulnerabilities and Interdependencies





Driving to a Sustainable Future: The “E”s are Linked



- ★ **Environment**
- ★ **Energy**
- ★ **Economics**
- ★ **Equity**
- ★ **Education**

